

# ***Soil Assessment Capabilities***



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This Presentation is:  
UNCLASSIFIED



# Learning Objectives

- Without the aid of references and IAW the material covered in this lesson, the PWTI will describe the soils assessment capabilities available.
- Without the aid of references and IAW the material covered in this lesson, the PWTI will know the appropriate penetration depth these capabilities should be driven for correct readings.



# Learning Objectives

- Without the aid of references and IAW the material covered in this lesson, the PWTI will understand the meaning of the acronym CBR.
- Without the aid of references and IAW the material covered in this lesson, the PWTI will describe what these capabilities can do for the MWSS.



# Background

- One of the most important properties that a soil possesses is its shearing resistance or shear strength.
- It is very important in its relation to the supporting strength or bearing capacity of a soil as a base or subgrade beneath a runway or other structure.



- For most applications, the California Bearing Ratio (CBR) value or the unconfined compression strength value of soil is used as a measure of shear strength.
- CBR is determined by a standardized penetration shear test and is used with empirical curves for designing and evaluating unsurfaced, aggregate, surfaced and flexible pavements or roads.



- Both the DCP and SACP described herein will test the CBR strengths of soils. The DCP is capable of measuring CBRs of 1 to well over 100.
- The SACP or ACP is capable of measuring CBR strengths of 1 to 15.



# DCP Description

- Consists of a steel rod with a steel cone attached to one end.
- Driven into the pavement or subgrade by means of a sliding dual/single mass hammer.
  - 17.6 lb.
  - 10.1 lb.
- From a height of 22.6 inches







- The cone penetration of one blow of the 17.6 hammer is equivalent to two blows by the 10.1 hammer.
- The 10.1 hammer yields better results in weaker soils - CBR of 10 or less.
- Can be used on soils up to 80 CBR.



# Disposable Cone

- Used in soils where the standard cone is difficult to remove.
- Mounts on an adapter.
- Slides off the adapter allowing removal of the DCP device from the soil.





# Go No-Go Gauge



- Used to ensure cone base diameter is within proper tolerance.
- Each cone should be checked before and at selected intervals to ensure proper cone diameter.
- The cone is within proper tolerance when it fits into only one end of the gauge.

# Basic Unit



- Top rod threaded and welded to the handle.
- Bottom rod threaded and welded to the anvil.
- Vertical scale in centimeters and inches.
- Six hardened 60-degree fixed cones.



# Accessories

- Disposable Cone Kit:
  - Four hardened cone adapters.
  - 200 disposable cones.
- Tool Kit:
  - Two pair of channel lock pliers.



# Use of the DCP

- Requires a minimum of two people to operate, preferably three.
- One holds the device in the vertical position.
  - The base of the cone must be flush with the surface of the soil.





- Second person checks the device for a zero reading.
  - By holding the vertical scale to prevent it from sinking into the soil.
- The bottom of the hammer should read zero millimeters on the vertical scale.
- Third person records the data.







- In weak soils the weight of the DCP will sink the cone past its zero reading.
- In this case, a zero blow penetration reading is recorded at the actual measured pretest depth.
- In other words if the cone sinks 15mm when placed, that 15mm along with zero blows is recorded.
- The hammer is then raised to the bottom of the handle and dropped.







- Ensure the hammer is touching the handle but not lifting the cone before it is dropped.
- The hammer must be allowed to fall freely
- Operator must be careful not to exert any downward force on the handle after dropping the hammer.



- Both the operator and the recorder keep track of the number of blows between measurements.
- The recorder is responsible for recording the penetration after each set of blows.
- Measurements are recorded to the nearest 5 mm.



- Cone must penetrate a minimum of 25 mm between recorded measurements.
- The number of blows between measurements will vary dependant upon soil strength and cone penetration rate.







- Any noticeable increases in penetration rate indicates a weaker soil layer.
- Should always record the blow count and penetration depth whenever a weaker soil layer is encountered.
- After the cone has been driven to the desired test depth (36 in), it can be removed from the soil. Caution must be exercised.



- Do not try to use force in order to get the device to penetrate the soil vertically.
- The handle must not be allowed to deviate from vertical 6 “or more.
- The test should be stopped and a new test attempted at another location.

# Reading Depths in Soil



- Soil strength usually increases with depth.
- Some cases a thin, hard crust will overlay a soft layer.
- Or the soil will contain thin layers of hard and soft materials.
- For this reason it is recommended that each penetration be made to a **depth of 36 inches.**



# Charting

Microsoft Excel - DCPmaster2									
File Edit View Insert Format Tools Data Window Help									
Arial 10 B I U									
B4		=SUM(C4)							
	A	B	C	D	E	F	G	H	I
1	No. of	Accumulative	Penetration	Penetration	Hammer	DCP	CBR	Depth	
2	Blows	Penetration	per Blow Set	per Blow	Blow	Index	Percent	Inches	
3		mm	mm	mm	Factor				
4	2	28	28	14.00	1	14.00	20.86	1.12	
5	12	55	27	2.25	1	2.25	129.78	2.19	
6	7	88	33	4.71	1	4.71	61.94	3.51	
7	6	114	26	4.33	1	4.33	67.38	4.54	
8		114		#DIV/0!		#DIV/0!	#DIV/0!	4.54	

# Expedient Construction Operations



- CBR values can be determined in an expedient manner using the SACP
- SACP was developed to provide a rapid, simple alternative to the standard CBR test



# Indicator Reading and Operation



- One Man Method
- Two Man Method (PREFERRED)





# SACP Operation

- Place both hands, palms down, symmetrically on the handles of the instrument
- Apply force with a slow, steady, downward movement
- Read load indicator when base of cone enters the ground (surface reading)
- Read indicator at corresponding depth marks (the shaft is marked in 3-inch intervals)









# Primary Concerns While Operating

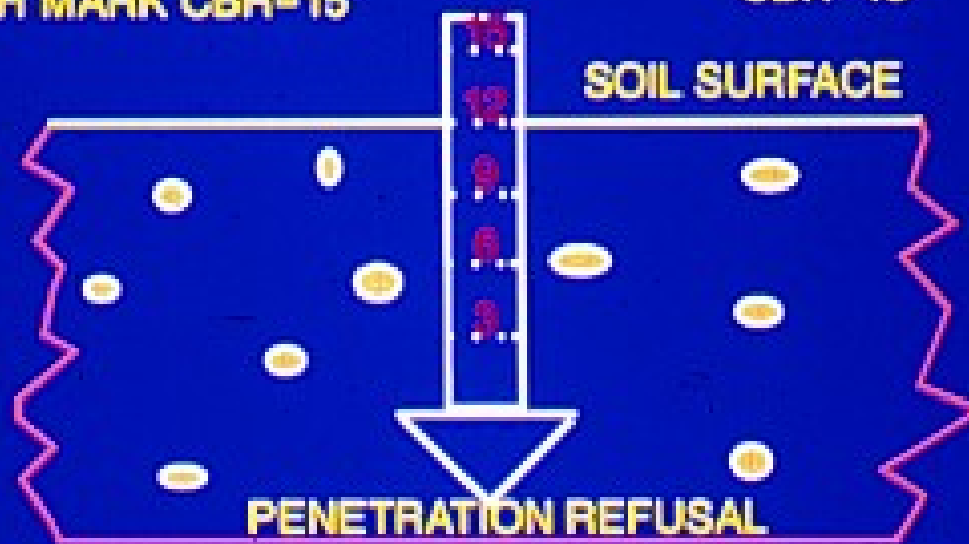
- Instrument should be kept vertical during operation
- Rate of penetration should be in the range of 1/2 to 1 inch per second



# SOIL ASSESSMENT

3 INCH MARK CBR=12  
6 INCH MARK CBR=13  
9 INCH MARK CBR=14  
12 INCH MARK CBR=15

READING DIFFERENCE 3  
TOTAL 54  
AVERAGE 13.5  
CBR=13





- Most dry sands and gravel will support AM-2 matting
- A minimum CBR of 4 is required to support AM-2 matting and aircraft operations



# ***WARNING!***

- Saturation sands, cohesionless silts, etc., which exist in a “Quick” condition (“0” Strength) must be avoided





# Weather Conditions

- Soil conditions are significantly affected by Weather
- Evaluation of soil strength is valid only for the period immediately after the measurements are made



- CBR measurements taken during:
  - Dry conditions, overestimates average soil strength
  - Wet conditions, underestimate average soil conditions



The DCP along with the SACP should provide you a means for sub-layer assessment when determining the trafficability of future/potential airfield sites and access roads.



# Summary

- Discussed the background of the DCP/SACP
- Described the DCP/SACP
- Identified their use for expedient construction operations
- Provided a rapid alternative for measuring subgrade soil strength
- Terms and definitions